

1.- 11 (Cancelled)

12. (Previously Presented) A method for producing a centralizer, the method comprising the steps of:

placing a length of metal tubular work piece, the work piece having a longitudinal axis, a sidewall and a central opening, inside a confining surface comprised of mold elements, the mold elements including cavities spaced and shaped in the configuration of desired side wall centralizer ribs, the mold elements being supported substantially against expansion radially outward from their position about the tubular work piece;

inserting a mandrel having a cylindrical exterior into the tubular work piece and sealing between an outer diameter portion of the mandrel and an inner diameter portion of the tubular work piece to define a sealed annular space between the mandrel and the tubular work piece;

applying sufficient fluid pressure to the annular space to force the tubular sidewall radially outward against the confining surface and into the mold cavities to plastically deform the side wall to form centralizer ribs on the side wall; and

removing the tubular work piece from the confining surface.

13. (Previously Presented) The method of claim 12 wherein:

the each of the mold elements has a cylindrical inner diameter and an end that abuts an adjacent one of the mold elements;

each cavity has a portion contained within one of the mold elements and another portion contained within the adjacent one of the mold elements; and

removing the tubular work piece from the confining surface comprises sliding the mold elements in axially opposite directions off of the tubular work piece.

14. (Previously Presented) The method of claim 12 wherein each of the cavities has opposite ends spaced apart from each other along a length of the confining surface.

15. (Previously Presented) The method of claim 14 wherein the ends of the cavities are also spaced circumferentially apart from each other to define a helical contour for each of the ribs.

16. (Previously Presented) The method of claim 12 wherein the mold elements contain axially extending slits to permit their circumferential expansion for removal thereof from the tubular work piece.

17. (Previously Presented) The method of claim 12 wherein the confining surface further comprises:

a cylindrical bell having a tapered bore therein with a larger inner diameter at one end of the bell than at another end of the bell;

a collet having a tapered outer surface that mates with the inner diameter of the bore, the mold elements being located within the collet; and

removing the tubular work piece from the confining surface comprises:

moving the collet axially relative to the bell; then

removing the tubular work piece along with the mold elements from the collet.

18. (Previously Presented) The method of claim 12 wherein:

each mold element has a cylindrical inner diameter and an end that abuts an end of an adjacent one of the mold elements; and

each cavity has a portion extending to one of the ends of the mold elements, the portions of the cavity joining each other.

19. (Previously Presented) The method of claim 18 wherein the mold elements contain axially extending slits to permit their circumferential expansion.

20. (Previously Presented) The method of claim 12 wherein the step of sealing between an outer diameter portion of the mandrel and an inner diameter portion of the tubular work piece

comprises placing annular seals between the tubular work piece and the mandrel at axially spaced apart distances.

21. (Original) The method of claim 12 wherein upon removal of the centralizer from the confining surface, the tubular work piece sidewall is of substantially uniform thickness.

22. (Previously Presented) The method of claim 12 further comprising applying a friction-reducing coating to the tubular work piece inner diameter portion once the tubular work piece has been removed from the confining surface.

23. (Previously Presented) The method of claim 12 further comprising treating exterior surfaces of the ribs to increase their wear resistance once the tubular work piece has been removed from the confining surface.

24. (Original) The method of claim 12 wherein removing the centralizer from the confining surface includes expanding the mold elements to overcome their hoop stress.

25. (Original) The method of claim 12 wherein the ribs are formed to protrude smoothly from the sidewall cylindrical outer surface.

26. (Cancelled)

27. (Withdrawn, ) A method for producing a centralizer for a pipe comprising:

providing a tubular work piece selected to be formed into the centralizer having a central opening defining an inner diameter and a sidewall having an inner-facing surface directed toward the central opening and an outer-facing surface;

providing a mold including a plurality of elements together forming an inner-surface defining a substantially cylindrical confining space and cavities formed in the inner surface positioned and configured so as to correspond to the position and configuration of ribs to be formed on the centralizer;

positioning the tubular work piece and the mold elements such that the tubular work piece is within the substantially cylindrical confining space formed by the mold elements;

placing the mold elements and the tubular work piece together within a bell; then

applying sufficient fluid pressure against the sidewall to force the sidewall out against the mold elements and into the cavities of the mold elements to form a centralizer having ribs protruding outwardly from its outer surface;

removing the centralizer and the mold elements from the bell; then

removing the mold elements from the centralizer.

28. (Withdrawn) The method of claim 27 wherein the step of placing comprises:

inserting a mandrel into the central opening of the tubular work piece such that an annular space is formed between the mandrel and the sidewall inner facing surface;

sealing about the annular space; and

the step of applying sufficient fluid pressure includes introducing fluid pressure to the annular space.

29. (Withdrawn) The method of claim 27 wherein the fluid pressure is air pressure.

30. (Withdrawn) The method of claim 27 wherein the fluid pressure is hydraulic pressure.

31. (Withdrawn) The method of claim 27 wherein:

the mold elements comprise two substantially cylindrical members that abut each other end-to-end;

each cavity has a portion in one of the mold elements and another portion in the other of the mold elements; and

removing the mold elements from the centralizer comprises sliding the mold elements in opposite directions relative to an axis of the mold elements.

32. (Withdrawn) The method of claim 30 wherein the mold elements contain axially-extending slits to permit their circumferential expansion.

33. (Withdrawn) The method of claim 27 wherein the the mold further comprises:

a tapered bore in the bell with a larger inner diameter at one end of the bell than at another end of the bell;

a collet having a tapered outer surface that mates with the inner diameter of the bore, the mold elements being located within the collet; and

removing the tubular work piece from the bell comprises:

moving the collet axially relative to the bell; then

removing the tubular work piece along with the mold elements from the collet.

34. (Withdrawn) The method of claim 27 wherein each mold element defines a portion of a cavity.

35. (Withdrawn) The method of claim 27 wherein the mold elements contain slits to permit their circumferential expansion.

36. (Withdrawn) The method of claim 27 wherein upon removal of the centralizer from the bell, the centralizer sidewall is of substantially uniform thickness.

37. (Withdrawn) The method of claim 27 further comprising applying a friction reducing coating to the centralizer inner surface once the centralizer has been removed from the bell.

38. (Withdrawn) The method of claim 27 further comprising treating exterior surfaces of the ribs to increase their wear resistance once the centralizer has been removed from the bell.

39. (Withdrawn) The method of claim 27 wherein removing the mold elements from the centralizer includes expanding the mold elements to overcome their hoop stress.

40. (Cancelled)